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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/590,357	09/14/2006	Jean-Xavier Morin	VA30455	6742

226 7590 07/28/2009

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EXAMINER	
WILSON, GREGORY A	

ART UNIT	PAPER NUMBER
3749	

MAIL DATE	DELIVERY MODE
07/28/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/590,357	MORIN ET AL.	
	Examiner	Art Unit	
	Gregory A. Wilson	3749	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 May 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *29,30,32-39,41-45,48-52,55-57 and 59-66* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *29,30,32-39,41-45,48-52,55-57 and 59-66* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 29, 30, 32-35, 39, 41, 48-51 and 60-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al (5,888,272) in view of Anderson et al (6,505,567).** Prasad et al discloses an ion transport membrane fed with pressurized air, which are known for use in the production of oxygen in a gas separation process. Prasad et al furthermore discloses the integration of an ion transport membrane-combustion module into a furnace atmosphere that is clean so as to form a singular unit

so as to create a heated oxygen which is directed into the furnace (firebox) to aid in combustion (SEE column 15, lines 15-25).

Prasad et al does not disclose the specific environment to be a circulating fluidized bed boiler for which the ion transport membrane would be operating in. Anderson et al teaches a circulating fluidized bed boiler (10) having a fire box (12) in which solid fuel is combusted in the presence of oxygen to generate flue gases containing heated solids, a fluidized bed (36) containing the heated solids fluidized by the fluidization gas (Anderson has a separator 18 which separates out the heated solids which flow to fluidized bed 36). Although Anderson does teach a high temperature oxygen production membrane (oxygen source 140) and pressurized air supplied to the fluidized bed (36) so as to enable the high temperature oxygen production membranes in the fluidized bed to extract oxygen from the pressurized air and an oxygen loop connected in fluid flow relation with the firebox for supplying the oxygen extracted from the pressurized air in the fluidized bed to be employed for purposes of affecting in the presence, the combustion of the solid fuel in the firebox, Anderson does not particularly teach that the high temperature oxygen production membranes are supported in the fluidized bed so as to be exposed to the heat from the portion of the separated solids returned via separator (18). Based on the disclosure that Prasad et al discloses an ion transport membrane incorporated into a furnace to form a singular unit, a person having ordinary skill in the art at the time the invention was made would have found it obvious to incorporate the teaching of Prasad et al of the ion transport membrane (oxygen transport membrane) into the fluidized bed (36) of Anderson (which would constitute a

clean environment since the bed material would not penetrate the ion transport membrane , but would have a heat exchange relationship) for the purpose of providing a more compact singular and thus more efficient structure still resulting in providing heated oxygen to the fluidized bed boiler.

In re claim 30, Prasad et al as modified by Anderson teaches a fluidization gas as being CO_2 which is fed through blower 172 into the fluidized bed heat exchanger (36) (SEE column 6, lines 57-60 and column 7, lines 4-6) (Anderson).

In re claim 32, Prasad et al as modified by Anderson teaches in Figure 2 (Anderson), a fluid line (unnumbered) leading from blower 172 for providing the combustion gas/fluidization gas and a line connecting the fluidized bed to the bed boiler/firebox (10) which is representative of the extracted oxygen from the fluidized bed.

In re claims 33 and 50, Prasad et al as modified by Anderson discloses that the air fed to the ion transport module is part of a feed gas steam (81) which is compressed in a blower or compressor (82) to produce feed gas stream (83) (Prasad et al).

In re claims 34, 35 and 61, Prasad et al as modified by Anderson teaches a fluidized bed (36) wherein the oxygen transport membrane of Prasad et al would be supported within the heated solids of the fluidized bed as taught by Anderson as noted

above and could be positioned above the heated solids as a matter of obvious design choice.

In re claim 39, Prasad et al as modified by Anderson teaches a circulating fluidized bed boiler wherein the fluidized bed (36) of Anderson can be external to a firebox (SEE Figure 2).

In re claim 41, Prasad et al as modified by Anderson teaches that the oxygen transport membrane includes tubes which will be at a high temperature, acting as heating elements (Prasad et al, column 14, line 64 – column 15, line 14).

In re claims 48 and 60, Prasad et al as modified by Anderson teaches that the oxygen transport membrane (ion transport module) is heated to temperatures in the range of 800-1200 degrees C. (SEE Prasad et al column 15, lines 18-19).

In re claim 57, Prasad et al as modified by Anderson et al teaches the applicants primary inventive concept but does specifically recite that the ion transport membrane comprises a plurality of oxygen transport membranes, however to modify the ion transport membrane to include multiple membranes would have been an obvious modification since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art.

In re claim 66, Prasad et al as modified by Anderson et al teaches that the oxygen transport membrane (120a) (of Figure 4 or Prasad et al) would be in a position disposed above the solids which would rest on the floor of the heat exchanger (36) (of Anderson et al).

Claims 36, 52 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al (5,888,272) in view of Anderson et al (6,505,567)** as applied to claims 29 and 49 above, and further in view of **Belin (6,532,905).** Prasad et al as modified by Anderson et al discloses the applicants primary inventive concept as stated above including a fluidized bed incorporated with an oxygen transport membrane, but does not particular disclose that the fluidized bed is disposed within a firebox. Belin teaches a fluidized bed boiler (10) with a fluidized heat exchanger (42) with tubes (56, SEE column 5, lines 4-7) located in the furnace enclosure (12) on the hearth (SEE Figure 1). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains to have modified the fluidized bed boiler assembly of Prasad et al in view of Anderson by locating the fluidized bed (36) of Anderson inside the furnace as taught by Belin and further supported by Prasad et al, in order to simplify the overalll construction of the circulating fluidized bed assembly and to permit easy access to enclosure walls for maintenance and inspections as explicitly taught by Belin (column 1, lines 65-67). The resulting structure has oxygen production membranes located on the hearth of furnace section (see Belin Figure 1, element 42 is located on hearth of firebox 12).

Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al (5,888,272) in view of Anderson et al (6,505,567)** as applied to claim 29 above, and further in view of **Hyppanen (5,476,639).** Prasad et al as modified by Anderson et al discloses the applicants primary inventive concept including a fluidized bed incorporated with an oxygen transport membrane as stated above, but does not disclose wherein the fluidized bed is open to the firebox for receiving descending solids in the firebox. Hyppanen teaches that it is well known in the art to include a fluidized bed reactor (10) that has a heat exchanger (24) located along the firebox wall (26) with openings (40) for particles to enter the heat exchanger (column 7, lines 61-63 and Figure 1). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the fluidized bed boiler system of Prasad et al in view of Anderson et al by locating the fluidized bed along the outside of the firebox with openings therein to receive particles from the firebox in order to reduce the number of individual units, reduce the number of connection lines, and improve efficiency. The resulting structure has oxygen production membranes (ion transport membrane) located in the fluidized bed heat exchanger on the outside of the firebox with openings therein to receive descending solid particles.

Claims 38 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al (5,888,272) in view of Anderson et al (6,505,567) and Hyppanen (5,476,639)** as applied to claims 29, 49 and 37 above, and further in view of **Dietz**

(5,054,436). Prasad et al as modified by Anderson et al and Hyppanen teaches the applicants primary inventive concept as stated above including a fluidized bed incorporated with an oxygen transport membrane wherein the fluidized bed is open to the firebox for receiving descending heated particles in the firebox, but does not teach wherein the fluidized bed extends along a portion of an inner wall of the firebox. Dietz teaches a fluidized bed combustion system (Figure 1) that has a heat exchanger section (24) located along the inner wall of the firebox (10). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the fluidized bed boiler system of Prasad et al in view of Anderson et al and Hyppanen by locating the fluidized bed (36) of Anderson in the firebox as taught by Dietz in order to reduce the number of individual units and connection lines and thus improve efficiency. The resulting structure has the ion transport membrane of Prasad et al located in the fluidized bed of Anderson et al on the lower periphery and inner wall of the firebox as taught by Dietz.

Claims 42 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al in view of Anderson et al** as applied to claims 29 and 49 above, and further in view of **Rogut (5,284,583).** Prasad et al as modified by Anderson et al discloses the applicants primary inventive concept including a fluidized bed incorporated with an ion transport membrane made of tubes that will be at a high temperature and act as heating elements as stated above, but does not specifically recite that the tubes are short with intermediate chambers. Rogut teaches a high temperature oxygen

production membrane (14) consisting of short tubes (membranes with long fibers operate at too low a productivity level, column 2, lines 12-16, the fibers should be in the range of 0.2 to 100 cm, column 3, lines 15-19) with intermediate chambers (transport arteries 12, Figures 9A, 9B, 15 and 16). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains to substitute the membrane arrangement as taught by Rogut for the membranes of Prasad et al in view of Anderson et al for the purpose of increasing the productivity efficiency of the oxygen production membranes.

Claims 43-45 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Prasad et al (5,888,272) in view of Anderson et al (6,505,567)** as applied to claims 29 and 49 above, and further in view of **Besecker et al (7,125,528).** Prasad et al as modified by Anderson et al discloses the applicants primary inventive concept including a fluidized bed incorporated with an ion transport membrane made of tubes that will be at a high temperature and act as heating elements as stated above, but does not specifically recite that the tubes are concentric tubes including an inner tube of which serves as a support for a tube of outer membrane. Besecker teaches a high temperature oxygen production membrane (52) consisting of concentric tubes (54, 56) of which the inner tubes serves as support for the outer tube, with regards to claim 44, Besecker teaches a space provided between the concentric tubes (Figure 5) wherein the air flow in a counter-current direction in the space between the tubes (claim 45). It would have been obvious at the time the invention was made to a person having

ordinary skill in the art to which the subject matter pertains to substitute the concentric tubes as taught by Besecker for the tubes of the ion transport membrane of Prasad et al in view of Anderson et al for the purpose of allowing a catalytic reaction to take place after the oxygen is separated from the oxygen-containing gas (column 5, lines 24-27).

Response to Arguments

Applicant's arguments filed 5/18/09 have been fully considered but they are not persuasive. Applicant argues that neither reference teaches or suggests "providing a fluidized bed comprising heated solids from the generated flue gas", the examiner respectfully disagrees and maintains that the heated solids which are returned to heat exchanger (36) of Anderson et al are solids which were entrained within the flue gases and are separated by separator (18) wherein the flue gases are directed to a backpass volume (22); the separated solids constitute solids from generated flue gas. The heated solids are directed to the heat exchanger (36) wherein by incorporation of reference of Prasad et al would include an oxygen transport membrane as stated in the obviousness rejection (above) whereby the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. Applicant furthermore argues that Prasad et al shows in Figure 4 an ion transport membrane 120 spaced from the combustor (130) to provide a hot zone 138 therebetween concluding that the spacing is

necessary to permit the internal circulation of the flue gas to sweep the oxygen from the ion transport membrane. The examiner maintains that Prasad et al teaches that the integration of an ion transport membrane-combustion module into a furnace atmosphere that is clean so as to form a singular unit so as to create a heated oxygen which is directed into the furnace (firebox) to aid in combustion (SEE column 15, lines 15-25) reads on the applicants limitation of the ion transport membrane (oxygen transport membrane) being capable of being placed in the fluidized bed heat exchanger (36) of Anderson et al. Applicants argument with regards to claim 49 that neither Prasad et al or Anderson et al teach or suggest heating an oxygen transport membrane with "sufficient" heat provided by the fluidized bed of hot solids separated from a flue gas from a fire box, is not persuasive, since it has already been established that Prasad et al as modified by Anderson et al provides some heating to the ion transport membrane which is incorporated into the fluidized bed heat exchanger and the phrase "sufficient" is a relative term which is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory A. Wilson whose telephone number is (571)272-4882. The examiner can normally be reached on 7 am - 4:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve McAllister can be reached on (571) 272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Gregory A. Wilson/
Primary Examiner, Art Unit 3749
July 26, 2009